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BROWN DWARFS AND JOVIAN PLANETS: A COMPARISON

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The recent detection of a subluminous companion to the M dwarf star VB8 (McCarthy et al., *1985,* Astrophys. J. *290, L9) has renewed interest in the characteristics of objects spanning the mass range from Jupiter to hydrogen burning stars. We have constructed atmospheric and interior models for objects in this mass regime, up to 30 Jupiter masses, with emphasis on understanding the relationship of "brown dwarfs" such as the VB8 companion to the better-studied Jovian planets. The atmospheric model solves the equation of radiative transfer assuming frequency dependent molecular opacity sources H_2, He, H_2O, CO, and CH_4 which are important by virtue of the high cosmic abundance of their constituent atoms. Condensation of cosmochemically important materials, iron and silicates, in the atmosphere is possible, and the effect of such grains as opacity sources is assessed. The luminosity of the object is presumed due to degenerate cooling following a collapse phase and possibly deuterium burning (Stevenson, 1978,* Proc. Astron. Soc. Austral. *3, 227-229), and an interior model is constructed using as an outer boundary condition the temperature and pressure level at which the atmosphere becomes convective. The interior model is analogous to Jupiter, with a large liquid metallic-hydrogen core and a thinner molecular-hydrogen envelope. At intermediate depths, a zone of neutral atomic hydrogen may be of much greater importance than in the interior of Jupiter. Although the physics of this region is extremely difficult to treat, the assumption that the interior is isentropic allows computation of the temperature-pressure profile through this region by interpolation from lower and higher pressures. The oxidation state of carbon in the outer envelope of a brown dwarf of similar age to Jupiter is a function of the object's mass: a 30 Jupiter-mass object would have CO, rather than CH_4, as the primary carbon species. This makes the wavelength dependence of the atmospheric opacity sensitive to the carbon to oxygen ratio, since the abundance of the primary source of molecular opacity, H_2O, decreases as more oxygen is tied up as CO. We display the infrared spectrum of brown dwarfs of various masses and ages, and assess the possibility of deriving compositional information on these objects from future infrared observations.*

The presentation summarized by the above abstract was the preliminary report of work which has now been published in several papers listed below. Details of the work may be found there.

REFERENCES

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